Joint NRC-EPA Guidance on a Conceptual Design Approach for Commercial Mixed Low-Level Radioactive and HazardousWaste Disposal Facilities

The following NRC-EPA Guidance on a conceptual design approach for a Mixed Low-Level Mixed Waste disposal site was published on August 3, 1987.

Introduction

The Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA) requires that the three operating low-level radioactive waste (LLW) disposal facilities remain available through 1992. By that time all states and compact regions are required to assume complete responsibility f or LLW disposal. Both existing and new disposal facilities may receive commercial mixed low-level radioactive and hazardous waste (Mixed LLW) which is regulated by the U S Nuclear Regulatory Commission (NRC) under the Atomic Energy Act (AEA) and by the U S Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act (RCRA) Mixed LLW is defined as waste that satisfies the definition of LLW in the LLRWPAA and contains hazardous waste that either (1) is listed as a hazardous waste in Subpart D of 40 CFR Part 261 or (2) causes the LLW to exhibit one of the hazardous waste characteristics identified in Subpart C of 40 CFR Part 261. To assist in applying this definition NRC and EPA issued joint guidance entitled Guidance on the Definition and Identification of Commercial Mixed Low-Level Radioactive waste and Answers to Anticipated questions on January 8, 1987.

This jointly developed NRC-EPA guidance document presents a conceptual design approach that meets the regulatory requirements of both agencies for the safe disposal of Mixed LLW. Other designs, or variation of the proposed design concept may also be acceptable under the requirements of both agencies and will be reviewed on a case-by-case basis as received.

EPA regulations in 40 CFR Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, identify the design and operating requirements for owners and operators that dispose of hazardous waste in landfills [264.300 to 264.317]. These regulations involve requirements for the installation of two or more liners and a leachate collection and removal system (LCRS) above and between the liners to protect human health and the environment. Exceptions to the double liner and leachate collection system requirements are allowed if alternative design and operating practices, together with location characteristics, are demonstrated to EPA's Regional Administrator to be equally effective in preventing the migration of hazardous constituent into the ground water or surface

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NRC regulations in 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste, indicate that long-term stability of the waste and the disposal site require minimization of access of water to the waste [61.7(b)(2)] and that the disposal site must br designed to minimize to the extent practicable the contact of water with waste during storage, the contact of standing water with waste during disposal and the contact of percolating or standing water with wastes after disposal [61.51(a)(6)]. The primary objective of the above NRC regulations is to preclude the possibility of the development of a "bath-tub" effect in which the waste could become immersed in liquid (e.g. from infiltration of surface water runoff) within a disposal unit below grade with a low-permeability bottom surface.

The guidance on a conceptual design approach that is offered in the subsequent paragraphs is intended to present basic design concepts that are acceptable in addressing the regulations of both the NRC and EPA with respect to requirements for liners, leachate collection systems, and efforts to minimize the contact of liquid with the waste. It should be recognized that the guidance is being provided at the conceptual level and that the design and details that are complementary to specific site conditions need to be engineered by potential waste facility owners and operators. The application of the guidance in this document will not affect the requirements for licences of waste disposal facilities to comply with all applicable NRC and EPA regulations.

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Conceptual Design

Sketches and a brief discussion of the design considerations for an above grade disposal unit are provided. This design concept has been developed primarily to demonstrate the intersection of EPA's regulatory requirements for two or more liner and a leachate collection system above and between liners and the regulations of the NRC that require the contact of water with the waste be minimized. In addition, the design concept fulfills the need under both agencies regulations to assure long term stability and minimize active maintenance after site closure.

In this approach, the Mixed LLW would be placed above the original ground surface in a tumulus that would be blended into the disposal site topography. Schematic details of some of the principle design features of an above grade Mixed LLW disposal unit are provided in the sketches accompanying this guidance document. Figure 1 depicts the three dimensional overall view of a conceptual Mixed LLW disposal unit; Figure 2 provides details of the perimeter berm, liners, and leachate collection system; Figure 3 presents a cross-sectional view of the covered portion of the disposal unit; and Figure 4 describes the final cover system.

In the overall view of the Mixed LLW disposal facility, the double liners and leachate collection and removal system are installed before the emplacement of the Mixed LLW and the cover system is added at closure. The leak detection tank and leachate collection tank are encircled by a berm that controls surface water runoff from precipitation that would fall directly on the waste facility site. The drainage pipes in the upper primary collection system would collect any leachate that could possibly develop above the top flexible membrane liner and below the emplaced waste. Any leachate

collected would drain through the pipes to the primary leachate collection tank where the leachate would be tested and treated if required. Any leachate collected by the lower leachate collection and removal system would drain to the leak detection tank. The development of significant amounts of leachate from the solidified waste after closure is not anticipated. This is because the closure requirements provide that the cover must be designed and constructed 1) to provide long-term minimization of water infiltration into the closed disposal facility, 2) to function with minimum maintenance, 3) to promote drainage and minimize erosion, and 4) to have a permeability less than or equal to the permeability of any bottom liner system. It is anticipated that the area shown on Figure 3 between the slope of the final cover and the run-on control berm, where the tanks are located would be regraded and the tanks removed at the end of the post-closure care period (normally 30 years) when leachate development and collection is no longer a problem.

Figure 2 provides the general details required by EPA regulations for the double liner and leachate collection and removal system. The perimeter berm for leachate runoff control would assure that all leachate is collected below the waste and safely contained and transported through the drainage layers and pipes to the tanks located outside the final cover slope. NRC's regulations requiring minimizing contact of the waste with water are fulfilled by requiring the waste to be placed above the level of the highest water table fluctuation and above the drainage layers where leachate would collect. The bottom elevation of the solidified Mixed LLW would be required in all instances to be at elevations above the top of the perimeter berm.

In Figures 3 and 4 the design concepts for the final cover over the solidified waste zone and the perimeter berm are presented. The actual zone for placement of solidified Mixed LLW consist of different options, depending on the licensee's selection. Options that would be acceptable include use of stable high integrity waste containers (HICs) that have the spaces between containers filled with cohesionless, low compressible fill material or placement of the waste in an engineered structure, such as a reinforced concrete vault. A cover system over the waste that would be acceptable to the EPA and NRC is shown in Figure 4. The cover system would consist of (1)an outer rock or vegetative layer to minimize erosion and provide for long-term stability (2) a filter and drainage layer that transmits infiltrating water off of the underlying low permeability layers (3) an impervious flexible membrane liner overlaying a compacted low permeability clay layer, and (4) a filter and drainage layer beneath the compacted clay layer. If the solidified waste zone does not consist of an engineered vault structure with a roof top, an additional compacted clay layer should be placed immediately above the emplaced waste to direct any water infiltration away from the waste zone. Mixed LLW that contains Class C waste as designated by NRC's regulations would need to provide sufficient thickness of cover materials or an engineered intruder barrier to ensure the required protection against inadvertent intrusion.

Variations on the above design approach may include placement of the Mixed LLW in an engineered reinforced concrete vault, a steel fiber polymer-impregnated concrete vault, or double-lined high integrity containers that are hermetically sealed. If proposed by license applicants, these variations would be reviewed by both the EPA and NRC on a case-by-case basis to evaluate their acceptability and conformance with established Federal regulations.

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